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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/379,753	08/24/99	GRIMBERGEN M	3948/USA/SIL

IM22/1020

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EXAMINER	
ZERVIGON,R	
ART UNIT	**PAPER NUMBER**
1763	5

DATE MAILED: 10/20/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trad marks

Office Action Summary

Application No.	Applicant(s)
09/379,753	GRIMBERGEN,MICHAEL N.
Examiner	**Group Art Unit**
Rudy Zervigon	1763

☒ Responsive to communication(s) filed on *Jul 31, 2000*

☒ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire *3* month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claim

☒ Claim(s) *1-59* is/are pending in the applicat

Of the above, claim(s) *15-22 and 52-56* is/are withdrawn from consideration

☒ Claim(s) *23-29* is/are allowed.

☒ Claim(s) *1-4, 11-14, 30, 31, 35-38, 40-51, and 57-59* is/are rejected.

☒ Claim(s) *5-10, 32-34, and 39* is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☒ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

— SEE OFFICE ACTION ON THE FOLLOWING PAGES —

DETAILED ACTION

Response to Election/Restriction Traversal

1. Restriction between the following inventions was required under 35 U.S.C. 121 in the prior Office Action:

I. Claims 1-14, 23-29, 30-51 drawn to an apparatus for substrate processing, classified in class 118, subclass 723AN.

II. Claims 15-22, 52-56, drawn to a method for monitoring plasma processing, classified in class 118, subclass 723AN.

2. Applicant's election with traverse of Group I in Paper No. 4 is acknowledged. The traversal is on the grounds that "the Groups defined by the Examiner have not been shown to be distinct" whereby "the apparatus is distinct from the method because the method is not limited by the apparatus". This is not found persuasive because, as before, the process as claimed can be practiced by another materially different apparatus not requiring the claimed attributes of claims 1-14, 23-29, 30-51 such as instead of a signal analyzer normalizing the spectral response, a neural network training algorithm may be employed as part of the apparatus for processing and conditioning. It is commonly known that signal processing techniques, such as neural network training, employ arithmetic normalization routines in order to enhance the interpretation of the output.

The requirement is still deemed proper and is therefore made FINAL.

Claim Rejections - 35 USC § 102

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 1, 2, 3, 14, 40, 41, 43 are rejected under 35 U.S.C. 102(b) as being anticipated by Sun et al (U.S. Pat. 5,664,066). Sun et al describe a neural network controller for plasma assisted process (column 5, lines 18-61) which is trained with optical emission spectra as produced from a radiation source contained within the plasma reactor. Specifically, Sun et al teach:

a. A process chamber (item 102, Figure 1) defining a chamber interior housing a radiation source where one or more work pieces are supported (column 11, lines 1-2) can be inserted for ion treatment

b. An energy source (item 138, Figure 1; column 10, line 64) for setting up an ion plasma within the process chamber

c. An optical sensor detector (items 112,114, Figure 1) for monitoring the intensity and wavelength (Figure 2; column 11, lines 1-59; column 13, lines 42-67) of the ion plasma and for providing optical analysis data (column 11, lines 1-59) of the radiation sources emanating from the plasma contained within the reactor

d. A data store (item 118, Figure 1; column 11, lines 65-67; column 12, lines 1-34) for correlating optical analysis data with a parameter of the ion plasma within the process chamber to allow adjustment of that parameter based upon an output from the optical sensor.

e. The data processing, or signal analyzer, of Sun et al is provided with instructions for normalizing a property, specifically output intensity value O_i (column 14, lines 1-9), of the first radiation I_i relative to a property (output intensity) of the second radiation A_i. Here the Sun et al numerator corresponds to Xt (line 20, page 14, specification - "variations canceled") and the sun et al denominator corresponds to Yt (line 20, page 14, specification). Additionally, Sun et al describe additional normalization techniques (column 14, lines 9-13) as would be anticipated to those skilled.

Specifically, Sun et al describe a method for monitoring a plasma process (column 10, lines 66-67 through column 11, lines 1-14). Sun et al implicitly describe first endpoint detection (column 4, lines 35-41) via a predetermined result (column 13, lines 30-42; column 14, lines 50-61) drawn from *evaluating a cumulative condition of all parameters effecting* the process plasma (column 3, lines 15-60). Additionally, Sun et al provide for *optical emission* collection and evaluation in the range of the far IR and near UV (column 4, lines 23-24) and the relevance of this spectral range to the plasma processing conditions (column 4, lines 25-28).

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1, 2, 4, 11, 44, 45, 46, 48, 49, are rejected under 35 U.S.C. 102(b) as being anticipated by BöBel et al (U.S.Pat. 5,564,830). BöBel et al describe plasma method an apparatus

for determining the thickness and temperature of coating materials in semiconductor manufacturing (column 1, lines 5-16). Specifically, BöBel et al describe a substrate (item 1, Figure 1; column 6, 1-24) processing apparatus with an inherent chamber consisting of:

f. A radiation source (item 6, Figure 1; column 6, 1-24)

g. A detector (items 7,8, Figure 1; column 6, 1-24) to detect a property of a radiation, in this case intensity (column 2, 45-50), and generate a reference signal

h. A radiation modulator (items 9, 4.1, 4.2, 8, Figure 1; column 6, 1-24) in a path of the radiation being transmitted from the radiation source to the chamber. The radiation modulator receives a signal from the radiation source and controls a property of the radiation in relation to a reference signal (item 10, Figure 1; column 6, 1-24). The controlled property in this sense being the filtered frequencies (low/high pass).

i. The radiation modulator additionally contains an electro-optical transducing means (item 7, Figure 1; column 6, 1-24)

7. Claims 44, 45, 46, 48, 49, are rejected under 35 U.S.C. 102(b) as being anticipated by Betz et al (U.S. Pat. 4,838,694). Betz et al describe plasma method an apparatus for determining wafer processing conditions in semiconductor manufacturing (column 1, lines 50-68). Specifically, Betz et al describe a substrate (item 1, Figure 3; column 4, 1-29) processing apparatus within a chamber consisting of:

j. A radiation source (items 100,70, Figure 3; column 4, 1-29)

k. A detector (items 70, Figure 3; column 4, 40-45) to detect a property of a radiation, in this case intensity (item 90,92, Figure 3; column 4, 61-69), and generate a reference signal

l. A radiation modulator (items 30,40,96, Figure 3; column 4, 1-29) in a path of the radiation being transmitted from the radiation source to the chamber. The radiation modulator receives a signal from the radiation source and controls a property of the radiation in relation to a reference signal (item 72, Figure 3; column 4, 1-29). The controlled property in this sense being the filtered frequencies (low/high pass).

m. The radiation modulator additionally contains an elector-optical transducing means (items 32,72 Figure 3; column 4, 1-45)

Claim Rejections - 35 USC § 103

8. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

9. Claims 42, 57-59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sun et al (U.S.Pat. 5,664,066). Sun et al describe a plasma processing apparatus as detailed above in the rejection to claims 1, 2, 3, 14, 40, 41, 43. However, Sun et al do not describe an apparatus with capabilities whereby the feedback controller (item 122, Figure 1) is adapted to maintain the property of the radiation, in this case the intensity, at a constant level.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to develop a control strategy whereby the feedback controller (item 122, Figure 1) is adapted to maintain the property of the radiation, in this case the intensity, at a constant level. The capabilities of the Sun et al apparatus are with these bounds according to the process variables reported to be controlled. These include flow (item 132, 134; Figure 1), pressure (item 136, Figure 1), and power applied to the plasma (item 138, Figure 1). Motivation for the feedback controller adapted to maintain the property of the radiation, in this case the intensity, at a constant level in the Sun et al apparatus would be, for example, to calibrate the output from the photodiode array providing for a more accurate assessment of peak intensities.

10. Claim 12, 13, 38, 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over BöBel et al (U.S.Pat. 5,564,830). BöBel et al describe a plasma method and apparatus for determining the thickness and temperature of coating materials in semiconductor manufacturing as described above in the rejection to claims 44, 45, 46, 48, 49. BöBel et al, however, do not particularly describe transmission of spectral radiation data through fiber transmission means.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the BöBel et al apparatus by implementing the well known optical data processing industrial standard of fiber transmissions in the BöBel et al apparatus. Motivation for transmitting the optical data through fiber communication means is drawn from the very benefits of such transmissions that are well known in the industry and include, but not limited to, the benefit of lessening dispersion that is more prominently present in transmission paths not using fiber.

11. Claim 12, 13, 30, 31, 35, 36, 37, 38, 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over BöBel et al (U.S.Pat. 5,564,830) in view of van Pham et al (U.S.Pat. 4,776,695). BöBel et al describe plasma method an apparatus for determining the thickness and temperature of coating materials in semiconductor manufacturing as described above in the rejection to claims 44, 45, 46, 48, 49. BöBel et al, however, do not particularly describe transmission of spectral radiation data through fiber transmission means. van Pham et al describe thin film thickness determination (column 1, lines 19-35) means in plasma assisted processing. Specifically, optical data collection via fiber transmission is taught by van Pham et al (column 3, lines 50-55).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the BöBel et al apparatus by implementing the well known optical data processing industrial standard of fiber transmissions in the BöBel et al apparatus as taught by van Pham et al. Motivation for transmitting the optical data through fiber communication means is drawn from the very benefits of such transmissions that are well known in the industry and include, but not limited to, the benefit of lessening dispersion that is more prominently present in transmission paths not using fiber.

Allowable Subject Matter

12. Claims 5-10, 32, 33, 34, 39 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

13. Claims 23-29 allowed.

14. The following is a statement of reasons for the indication of allowable subject matter: Claims 23-39 are found to be allowable over the prior art retrieved. Specifically, Sun et al (U.S.Pat. 5,664,066) which provides the closest teachings of the above rejected claims nowhere provides a motivation for collecting, apart from the plasma emissions, a separate emission signature characteristic of a reflection of radiation from the plasma confines. C.F.F. Karney et al[1] do describe how reflected radiation, originating from plasma excitations, "complicate the spatial localization of plasma emission and are often difficult to diagnose" (Section I). However, a combination of Sun et al and C.F.F. Karney et al do not provide an obvious perspective or motivation for arriving at the allowed or objected claims.

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[1]*Rev. Sci. Instrum.*, **70**(1), January, 1999

Response to Arguments

15. Applicant's arguments filed August 9, 2000 have been fully considered but they are not persuasive.

16. The Examiner maintains his position concerning the Sun et al reference showing a data processing, or signal analyzer, of Sun et al is provided with instructions for normalizing a property, specifically output intensity value O_i (column 14, lines 1-9), of the first radiation I_i relative to a property (output intensity) of the second radiation A_i. Here the Sun et al numerator corresponds to Xt (line 20, page 14, specification - "variations canceled") and the sun et al denominator corresponds to Yt (line 20, page 14, specification). Additionally, Sun et al describe additional normalization techniques (column 14, lines 9-13) as would be anticipated to those skilled. As discussed by Sun et al, the second radiation A_i as "the nearby average intensity", is recorded as "a small range of channels" where channels, as shown by Figure 2 are differing wavelengths (column 13, lines 42-47). Thus the second radiation A_i is representative of not only one additional radiation above that of O_i (column 14, lines 1-9), but represents a selectably large number of channels or radiation wavelengths.

17. The Examiner maintains his position concerning the Sun et al reference teaching collecting and analyzing an electromagnetic spectrum produced by sources including plasma and process related sources, not including plasma sources, because the experiments conducted (column 13, lines 60-67) collected "background information" which would contributed by, possibly, the "subject surface" (column 10, line 66 - column 11, line 5).

18. The Examiner maintains his position concerning the BöBel et al reference teaching normalizing (column 3, lines 30-35) a property, in this case the pyrometer signal "P", of a first detected radiation relative to a property of a second detected radiation "P_o" as a function of *a single, different radiation wavelength* λ_o(column 3, lines 30-35).

19. The Examiner maintains his position concerning the BöBel et al reference teaching a radiation modulator (items 9, 4.1, 4.2, 8, Figure 1; column 6, 1-24) in a path of the radiation being transmitted from the radiation source to the chamber. The radiation modulator receives a signal from the radiation source and controls a property of the radiation in relation to a reference signal (item 10, Figure 1; column 6, 1-24). The controlled property in this sense being the filtered frequencies (low/high pass). The sole purpose of the chopper, as item 9 in Figure 1, is to modulate and thus remove noise whose frequency corresponds to the frequency of the angular rotation of the chopping blades. BöBel et al thus implicitly teach controlling a property (background noise filtration as manifested from background radiation - high pass filtration) of radiation from a radiation source (light radiation source, reflected off of substrate - returning light beam (figure 1)) in relation (mixed frequencies) to a reference signal (12,10; Figure 1) generated by the detector (items 7,8 - column 6, lines 16-24, 28-41).

20. The Examiner maintains his position concerning the Betz et al reference teaching a radiation modulator (items 30,40,96, Figure 3; column 4, 1-29) in a path of the radiation being transmitted from the radiation source to the chamber. The radiation modulator receives a signal from the radiation source and controls a property of the radiation in relation to a reference signal (item 72, Figure 3;

column 4, 1-29). The controlled property, in this sense, being the filtered frequencies (low/high pass filtration).

21. The Examiner maintains his position concerning the Sun et al reference teaching a radiation source other than a plasma. Implicitly, radiation, other than that directly from the plasma is collected, from sources, such as from light emissions from the plasma substrate interface (column 2, line 66 - column 7, line 5).

22. The Examiner maintains his position concerning the Sun et al reference teaching prima facie capabilities of the Sun et al apparatus to affix (maintain constant) a property of the radiation, in this case a digitally filtered intensity ("preprocesses", item 140, column 11, lines 50-53) signal from the optical spectrometer. Motivation for the feedback controller adapted to maintain the property of the radiation, in this case the intensity, at a constant level in the Sun et al apparatus would be, for example, to calibrate the output from the photodiode array providing for a more accurate assessment of peak intensities.

23. The Examiner maintains his position concerning the BöBel et al reference showing a prima facie obviousness for fiber optic radiation transmission as claimed in claims 12, 13, 38, and 51. Specifically, in response to applicant's argument that BöBel et al is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24

USPQ2d 1443 (Fed. Cir. 1992). In this case, the BöBel et al reference only differs from the claimed apparatus only through light fiber transmission.

24. The Examiner maintains his position concerning claims 12, 13, 30, 31, 35, 36, 37, 38, and 51 of the BöBel et al reference in view of van Pham et al showing a prima facie obviousness for fiber optic radiation transmission. Specifically, in response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, van Pham et al describe optical data collection and processing (column 3, lines 63-65), similar to BöBel et al, however the optical data collection and processing is accomplished via optical fiber transmission (column 3, lines 50-55). As such, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the BöBel et al apparatus by implementing the well known optical data processing industrial standard of fiber transmissions in the BöBel et al apparatus as taught by van Pham et al. Motivation for transmitting the optical data through fiber communication means is drawn from the very benefits of such transmissions that are well known in the industry and include, but not limited to, the benefit of lessening dispersion that is more prominently present in transmission paths not using fiber.

Conclusion

25. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

26. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official after final fax phone number for the 1763 art unit is (703) 305-3599. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661. If the examiner can not be reached please contact the examiner's supervisor, Gregory L. Mills, at (703) 308-1633.

GREGORY MILLS
PRIMARY EXAMINER